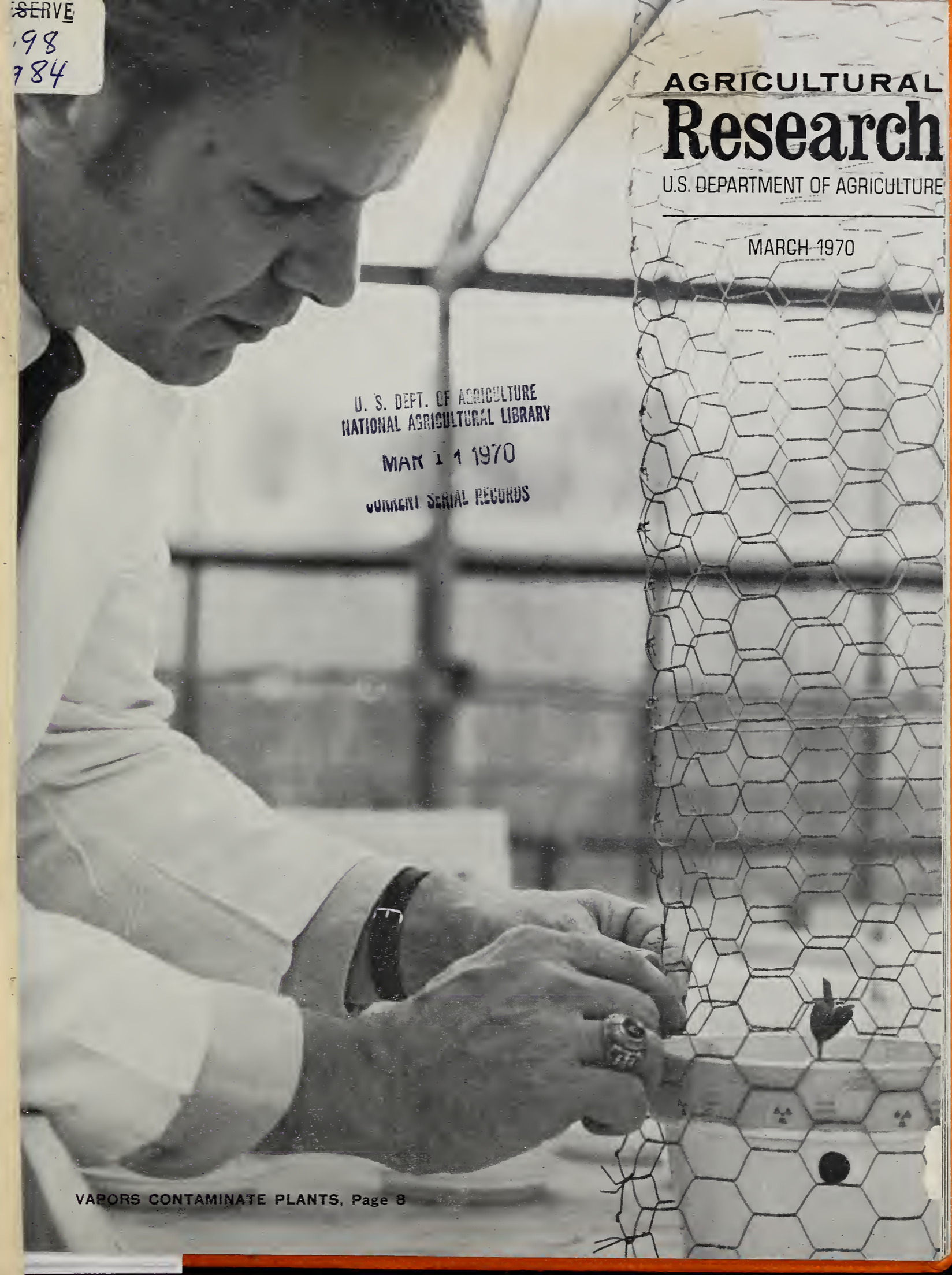

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MARCH 1970

VAPORS CONTAMINATE PLANTS, Page 8

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Invisible Allies

Microbes are man's busy, if invisible, allies. Ever since Pasteur's discovery in 1857 that these tiny creatures could sour milk, scientists have been harnessing the energy of living microbes to advance our physical and economic well-being.

To recruit these valuable allies, ARS maintains the world's largest assemblage of industrially-important micro-organisms in its Culture Collection at Peoria, Illinois. It now contains over 38,000 species and strains of yeast, fungi, bacteria, and actinomycetes deposited by donors around the globe. A kind of microbial bank, the Collection's cultures are drawn upon by ARS scientists and their colleagues in industry and academe.

The Collection also performs vital public services. It serves as a depository for all micro-organisms involved in U.S. patent applications. And it provides an internationally recognized identification function because most of its cultures are freeze-dried, sealed in glass ampules, and refrigerated, thus the organisms remain viable for years yet are free of contamination and mutation.

Micro-organisms from the ARS Collection quickly and economically convert agricultural byproducts into antibiotics, vitamins, and processing materials for industry. A few examples include cultures used in producing penicillin, the blood plasma-extender dextran, riboflavin (Vitamin B_2), and industrial alcohol. ARS scientists also developed ways to process these and other fermentation-derived products on a large scale.

Looking ahead, scientists are trying to find new and vital jobs for microbes. The world population explosion, for example, is prompting the search for microbes that can convert hydrocarbons present in processing wastes into protein-rich food for people. Perhaps the most important role for microbes in the near future may be in the fight against pollution because they can help purify water by removing soluble nitrogen and phosphorus. Scientists have already shown that grass-covered basins make efficient complex natural systems that cleanse sewage effluent. Indeed, the quality of the nation's water supply may depend substantially upon a fuller understanding of how microbes degrade organic wastes.

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Clifford M. Hardin, Secretary
U.S. Department of Agriculture

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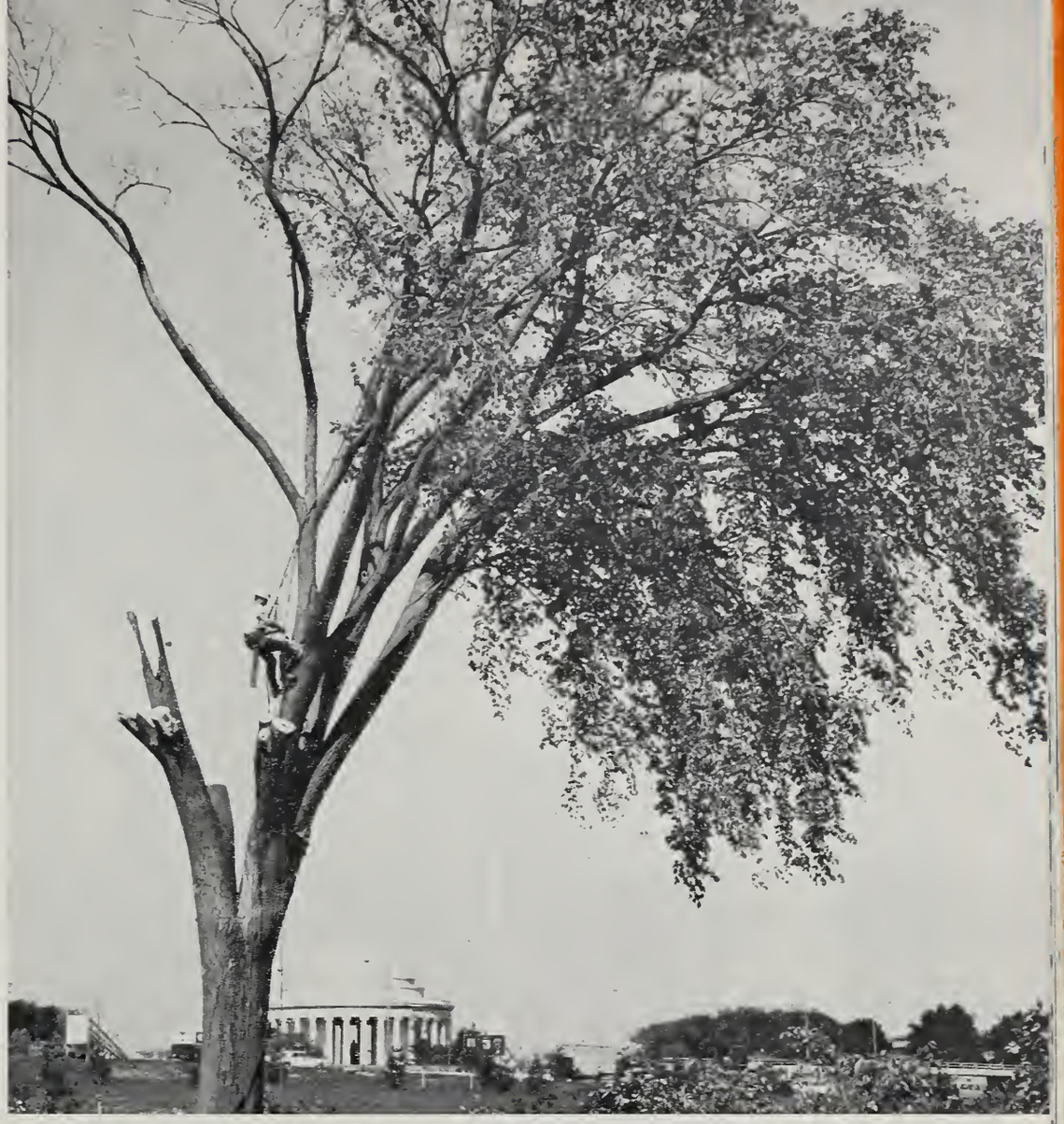
Agricultural Research Service

. . . closer to curing the ELM



This American elm, a landmark in Washington, D.C., had lived for almost 80 years. But it did not live to see 1970. Several years ago, it died of Dutch elm disease (ST–1599–4).

IN THE CONTINUING and frustrating search to control Dutch elm disease (DED), there now appears a glimmer of hope. It lies in benomyl, one of the new generation of nonpersistent, specific systemic fungicides.

DED, first detected in this country about 1930, is carried from tree to tree by the European elm bark beetle. Spores of the contaminating fungus are deposited by the beetles in feeding wounds and are then disseminated throughout the tree. As the fungus spreads and grows, it inhibits movement of life-sustaining fluids throughout the elm. This destructive fungal disease has not only denuded thousands of lovely elm-lined avenues throughout 30 Eastern and Midwestern States but has cost this country hundreds of millions of dollars.

Recently, ARS plant pathologists W. K. Hock and L. R. Schreiber and ARS plant physiologist B. R. Roberts at the ARS Ornamental Plants Laboratory in Delaware, Ohio, obtained some remarkable results in preliminary laboratory tests of benomyl.

For the tests, 1-, 2-, and 3-year-old elm seedlings were grown under controlled environmental conditions. After several treatments with the fungicide applied to the potting soil, the seedlings were inoculated with the disease-producing fungus, and then once again given further benomyl treatments. Of the plants thus treated, only 1.7 percent showed disease symptoms, while 43 percent of the untreated plants were affected. The fungus was not found in any of the treated trees but was found in 80 percent of the untreated ones.

The long search for a weapon against this disastrous disease has led down many avenues of chemical and biological controls, but all have met with only limited success. The recent development of systemic fungicides such as benomyl, however, has once again given impetus to the search.

Although the results with benomyl are significant, exhaustive testing remains to be done both in the laboratory and in the field. USDA has not registered benomyl for treatment of Dutch elm disease.■

essential for reproduction

ZINC

ZINC, one of those mysterious trace minerals that's needed to keep mouse, man, and broccoli alive and healthy, is losing a little of its mystery.

Zinc, it appears, is very much involved with reproduction. Studies by ARS biochemist B. J. Apgar at the U.S. Plant, Soil, and Nutrition Laboratory, Ithaca, N.Y., indicate that zinc is essential for breeding and implantation, maintaining a healthy pregnancy, and giving normal birth.

Apgar intensified the effects of zinc deficiency by removing the mineral from the diets of female rats 2 weeks before they were bred.

As a result, the number that were able to breed decreased sharply. About half of those that did breed did not become pregnant, or resorbed shortly after implantation.

The zinc-deficient female rats will breed, however, if they are given zinc or a sex hormone, either estradiol or human chronionic gonadotropin. Furthermore, most of the deficient rats will also implant if extra hormones are administered. Even with this extra hormone, however, only about half the females can maintain pregnancy full term.

Dr. Apgar found that 3 parts per million zinc in the drinking water was sufficient to insure mating, implantation, and maintenance of pregnancy. But since the pregnant females ate much less just before giving birth—a characteristic of zinc deficiency—3 ppm may not be enough for a normal delivery.

Many of the zinc-deficient female rats that carried their young to term had an extremely difficult delivery. Most of the young died in the process and frequently the mother died too.

Research elsewhere suggests that zinc is also important in the development and maturation of sexual characteristics in human beings. Apgar's work certainly supports this view.

In addition, zinc is very important in promoting adequate wound healing. Some scientists and doctors believe they can spot zinc-deficient individuals in a hospital simply by checking to see how well their surgical wounds are healing. Administration of extra zinc frequently speeds up the healing process.

In the past, zinc-coated galvanized articles such as cooking utensils have inadvertently been a good source of zinc for the family. Today, with the decreasing use of these articles in the home, people are becoming increasingly dependent on plants as a source of zinc.

Apgar was a member of the team which first determined the structure of a ribonucleic acid. The former leader of the team, R. W. Holley, was awarded the 1968 Nobel Prize in physiology or medicine for this work, which was done at the Ithaca laboratory from 1958 to 1964.■

Spies analyzes results of tests on uterine strips from sensitized guinea pigs. His assistant, M. A. Stevan, prepares another test (1169D152–14).

an allergy puzzle

THE FAMILIAR SCREENING TEST for allergy, in which a suspect substance is rubbed into a scratch on the patient's arm, does not always work. Sometimes an individual who is allergic to milk, for example, may show no reaction whatever to this test when the milk proteins responsible for his allergy are used.

Scientists have long suspected that *delayed* allergic responses to food—those manifest anywhere from 1 to 36 hours later—are due to a sensitivity, not to the food itself, but to some product of its digestion.

But not all the allergies that escape detection by the scratch test are delayed. Some people may suffer a severe allergic reaction only five minutes after ingesting a food to which they give a negative response in the scratch test. Is it possible that digestion simply occurs at an abnormally fast rate in such cases? Thus, substances in the food, harmless in their original state, may be almost immediately converted into those that cannot be tolerated by the patient.

This possibility was raised by chemist J. R. Spies of the ARS Eastern utilization research laboratory in Washington, D.C., who is doing research on the allergens of milk.

Spies and his colleagues treated the proteins of milk with the enzyme pepsin in a laboratory simulation of the digestive process. They allowed the process to continue for only 8 minutes. Then they tested the digests to determine whether they contained any "new" antigens—substances not present in the original protein but capable of causing an allergic reaction. One test involves applying the protein digest to uterine strips taken from guinea pigs previously sensitized by injection with the same substance. Another test involves the formation of a precipitate on mixing the protein with the blood serum of a rabbit previously sensitized.

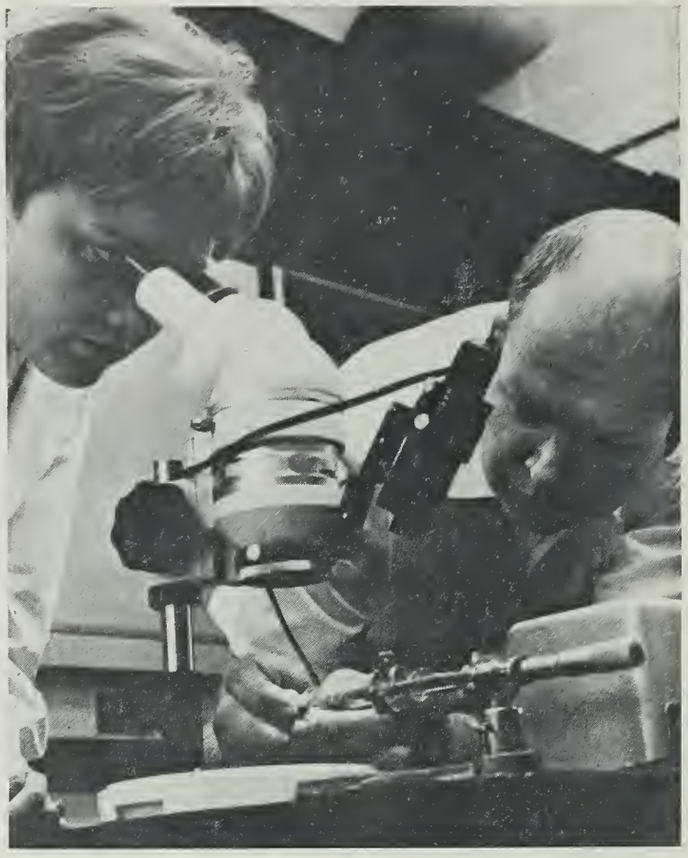
The first tests failed to show that any new antigens had formed. So, using a process called dialysis, Spies passed the digests through a membrane to separate them into two fractions—the dialysate, which passed through the membrane, and the endo fraction, which was retained. If the new antigens formed were low in molecular weight, they would be concentrated in the dialysate.

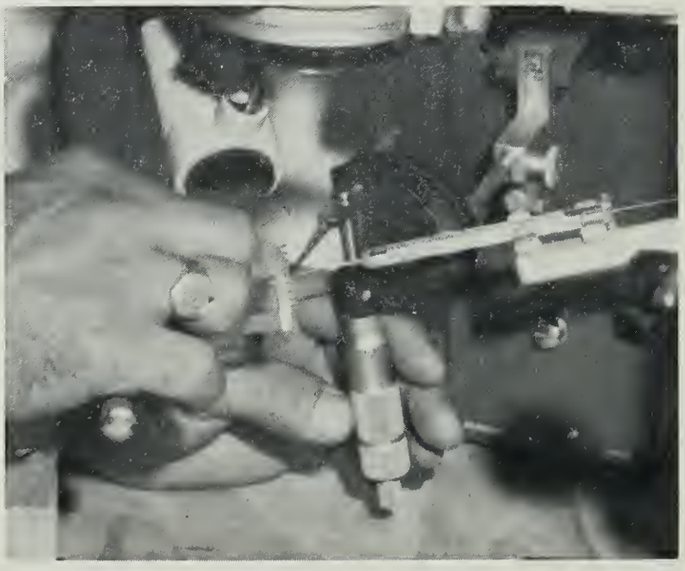
Tests of the dialyzed protein digests gave some evidences of new antigenicity, but results were not conclusive. The next step was to digest separately four components of the milk protein—casein, alpha-lactalbumin, beta-lactoglobulin, and bovin serum albumin. When Spies dialyzed these individual protein digests, he found what he was looking for. The casein was not remarkable for forming new antigens, but the three other proteins did so consistently. Since 80 percent of milk protein is made up of casein, it is not surprising that when the total milk protein digests were used, casein masked the activity of the minor proteins in forming new antigens.

When he applied the dialyzed digests of alpha-lactalbumin and beta-lactoglobulin to uterine strips from sensitized guinea pigs, Spies found a consistent reaction that did not occur with undigested protein. With bovine serum albumin, he noted the reaction with the endo fraction as well as with the dialysate.

None of the new antigens in the dialysates precipitated with the blood serum of rabbits sensitized with these fractions. However, the endo fraction of the bovine serum albumin did show a reaction in this test, indicating the formation of an antigen not present before digestion. Thus, both the uterine and precipitin tests detected the new antigen in the albumin.

These laboratory tests are only preliminary. Now Spies and his associates are looking for people who give an *immediate* allergic response on drinking milk, yet show a negative response to the usual scratch test. If they react positively to these laboratory digests of milk proteins, perhaps future screening tests (not only for milk allergies, but for other food allergies as well) may include laboratory digests as well as the whole proteins.■





Riemann shows lab technician Janice Bartell how to inject an extract into the reproductive tract of the female house fly (PN–1847, PN–1848).

the FRIGIDITY FACTOR

HOUSE FLIES and many other insects mate but once—a trait that could doom the pests if entomologists can pin down the factors which halt the insect's readiness to mate.

ARS entomologist J. G. Riemann and his associates at the Metabolism and Radiation Research Laboratory, Fargo, N. Dak., found a protein-containing substance produced by male house flies that acts as a monogamy or frigidity factor. This accessory secretion is made by glandular cells in the male's ejaculatory ducts and is passed with semen to female flies.

The secretion causes the female to spurn mating attempts by other males and stimulates her egg production. Riemann found that females remated, however, and produced fewer eggs than normal after mating with males from which he had removed the ejaculatory ducts, the source of the frigidity factor.

In related tests, ARS entomologist T. S. Adams and chemist D. R. Nelson produced similar effects with water extracts of the frigidity factor.

Their studies indicate that extracts of the abdominal tissue from 10 males is sufficient to prevent remating when injected in a female. The insect's blood carries the active material to the inhibition site—as yet unidentified but probably nerve or gland tissue—and so bypasses the natural application site in the insect's reproductive system.

ARS entomologists R. A. Leopold and A. C. Terranova recently discovered that the ejaculatory duct secretion contains a high concentration of the amino acid arginine. By injecting radioactive arginine into male house flies after they have been repeatedly mated to females, these scientists are able to obtain males with ejaculatory ducts containing radioactive accessory secretion.

This method of "tagging" the secretion with an easily traceable substance will help scientists obtain more information about the influence of the frigidity factor on house fly mating behavior. Equally important, this tagging method may expedite efforts to identify the females' mating inhibition site as well as to isolate and purify the active factor.

If the active material can be isolated and identified, scientists may produce it synthetically, so it can be employed to prevent mating. Because of the short lifespan of flies, rapid effects on the pest populations could be expected. This research is an additional effort to develop selective methods of insect control.■

Plant defense against herbicides

COTTON and several other plants are protected from adverse effects of some herbicides by the plants' natural enzyme system, which detoxifies the weed killers.

And this newly discovered enzyme system has several potential laboratory applications, say ARS chemists D. S. Frear, F. S. Tanaka, and plant physiologist H. R. Swanson. For example, laboratory tests with the isolated enzyme system may help scientists develop pesticides that are chemically compatible for specific crops. Such tests may also be useful in preliminary screening to select the most promising pesticides for field studies.

An enzyme test could also help indicate which insecticides and herbicides could be used safely together. Although pesticides may be harmless to crops when used singly, certain combinations can injure or kill crops.

In studies at the ARS Metabolism and Radiation Research Laboratory, Fargo, N. Dak., five of eight *carbamate* insecticides inhibited the enzyme system's ability to detoxify urea herbicides with which the insecticides had been combined. However, none of the tested *organophosphate* insecticides inactivated the enzyme system, indicating that these insecticides could be safely used with the herbicides.

Of 14 plant species tested at Fargo, Frear and his associates obtained the greatest enzyme activity from stem tissue of cotton seedlings. The scientists found the enzyme system was less active, although effective, in leaves of cotton, buckwheat, wild buckwheat, broadbeans, carrots and plantain.

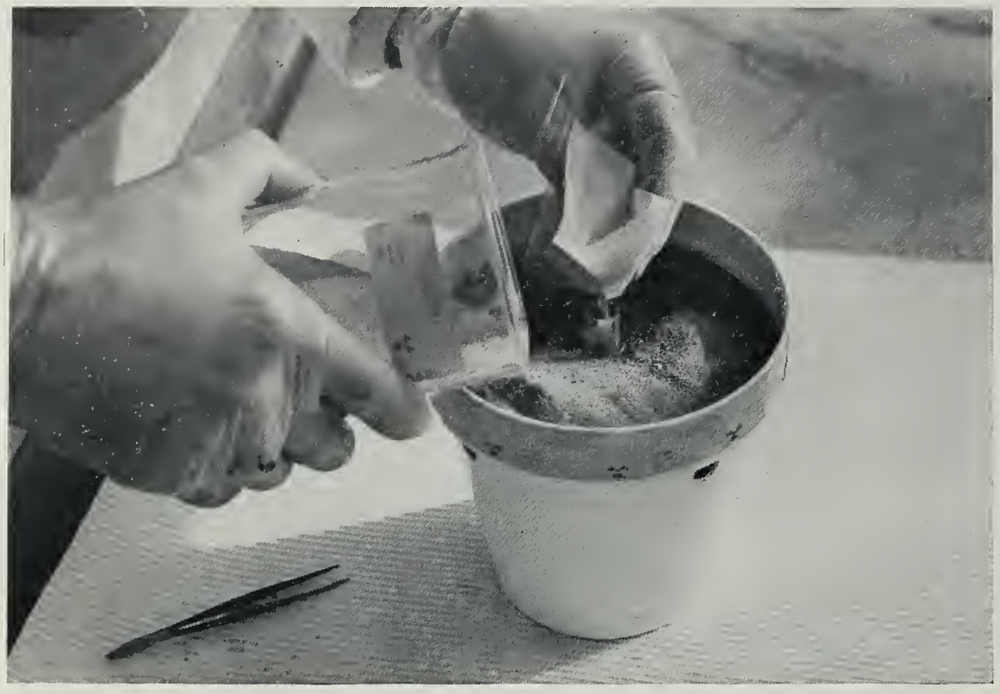
Little enzyme activity was found in celery, corn, mallow, okra, onion, potato, sorghum or soybeans—which may explain the greater susceptibility of these crops to phenylurea herbicide injury.

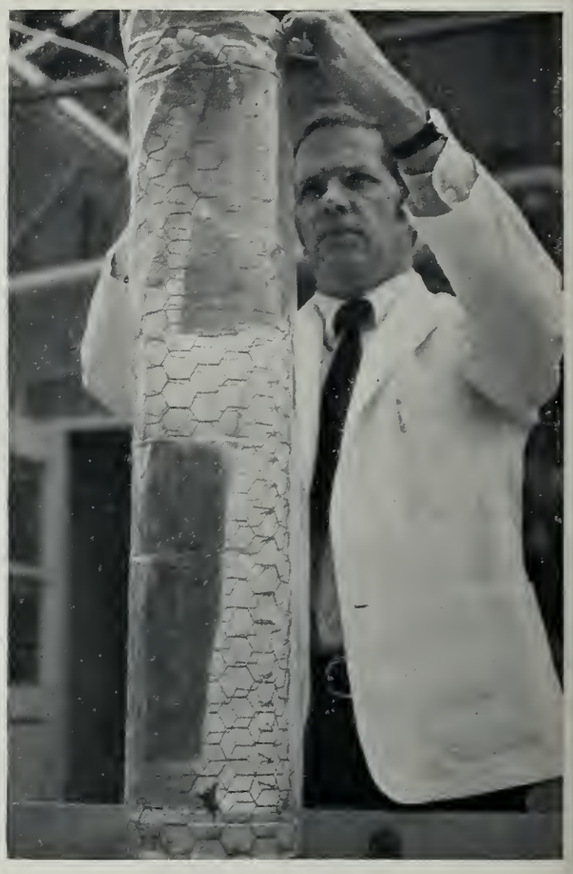
The Fargo scientists isolated the elusive plant enzyme system by centrifuging extracts of leaf or stem tissue at speeds several thousand times the force of gravity to spin off various subcellular constituents or fractions. One fraction that they isolated contained the plant enzyme in the microsome, fragments of the membrane structure embedded in cell protoplasm.

The active enzyme, N-demethylase, and a co-enzyme, NADPH, act together with oxygen dissolved in plant tissue to convert certain urea herbicides into compounds significantly less toxic to plants. The enzyme system appears to be specifically effective for most of the weed killers chemically known as substituted phenylurea herbicides. Common weed killers of this type include monuron, diuron and fluometuron.

This discovery may help scientists identify similar enzyme systems that enable crops and weeds to detoxify other kinds of pesticides. As with all basic research, these findings obtained from plant tissue must be tested further—using intact plants under both laboratory and field conditions to explore the various possibilities. ■

Cover and right: Beall prepares wire cage around potted seedling and covers it with plastic sheeting to protect it from external disturbances (1269A244–23, 1269A244–18). ***Below:*** *Seedlings were grown through glass tubing in special pots and insecticides were labeled with radioactive carbon to aid tracing (1269A237–12).*





vapors/ another route to plant contamination

Vaporization of chlorinated hydrocarbon insecticides from soil surfaces may be an important source of plant contamination.

ARS soil scientist R. G. Nash and plant physiologist M. L. Beall found in experiments that the aerial plant parts were contaminated by insecticides volatilizing from soil surfaces as well as by root absorption and translocation.

The scientists tested soybean plants and four insecticides—DDT, dieldrin, endrin, and heptachlor. They designed pots with a fiberboard seal separating surface from subsurface soil, and plants were grown through glass tubing that isolated the surface soil from the plant. Only roots touched the soil. A see-through cylinder, 3 feet high, surrounded the plants to prevent air currents from affecting movement of the insecticide vapors.

Soybeans were planted in pots where only the subsurface soil was treated with insecticides and in pots where only the surface soil was treated. When the plants were harvested 53 days after treatment, the scientists found residues in the aerial parts of all the plants regardless of where the insecticides had been incorporated.

Nearly seven times as much DDT residue was found in the plant tops as a result of vaporization from the surface soil as was found in the plants that absorbed the chemicals from the subsurface soil through their roots only. And plants grown on the surface-treated soil had twice as much DDT residue in their lower leaves as in the upper leaves.

The amounts of the other three compounds in the plant tops resulting from vaporization were about the same as those of DDT, but they differed significantly because of the root absorption and translocation.

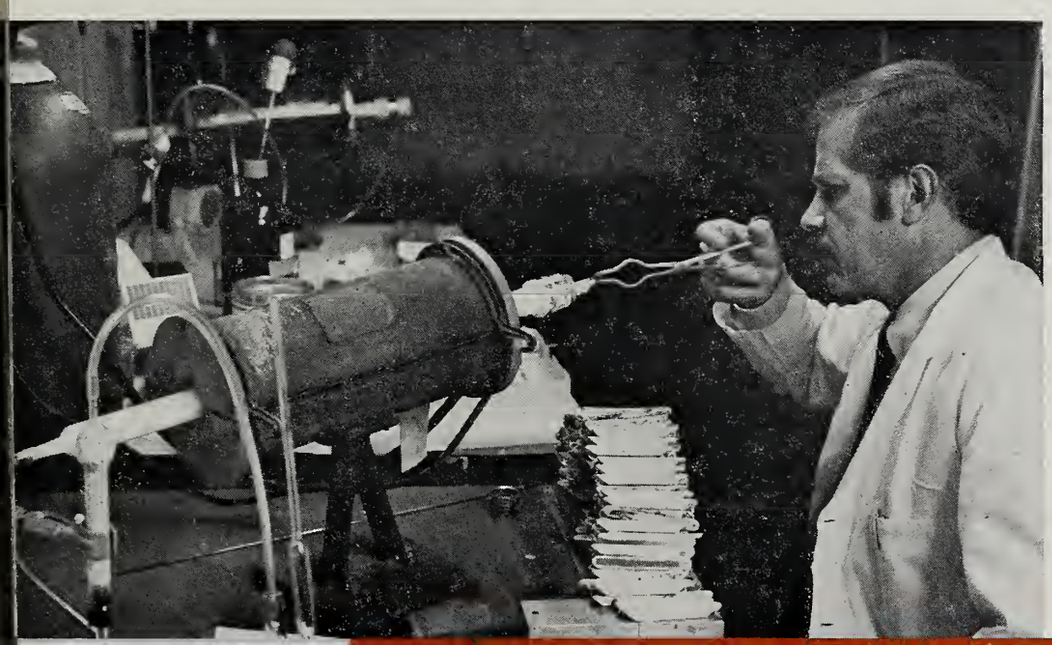
Interestingly, in all cases the seeds always contained the lowest residue concentrations.

ARS scientists are searching for methods of identifying and reducing sources of environmental contamination. Once avenues of pesticide entry into the food chain are pinpointed, steps can be taken to reduce their residues to safe levels or even eliminate them altogether.

The research findings of Nash and Beall are a major step in this direction. In their experiments they have been able to clearly separate and measure two major sources of plant contamination.

The test equipment and technique developed by these two researchers will provide valuable information in the Department's continuing search for safer, more economical, and effective ways of protecting crops.■

Left: *Mature plants were cut and divided into stems, leaves, seeds, and pods (1269A241–24).* ***Lower left:*** *Beall places samples into combustion chamber to reduce samples to water, carbon dioxide, and ash. The carbon dioxide includes the radioactive carbon which is trapped in a solution. The solution is loaded into a liquid scintillation counter which measures in parts per million the amounts samples contained (1269A240–13).* ***Below:*** *The radioactive carbon in samples can also be counted by extracting it from the samples and then injecting the extract, as Nash does here, into a gas-liquid chromatograph (1269A242–5).*



journey of an iris

*Above: Bulb harvest time in Puyallup, Wash. (PN–1850). **Below left:** Stuart weighs and measures flowers. This and other data permit evaluations of slight environmental variations (1269A291–11). **Below right:** Shed near Washington bulb field where newly harvested bulbs are cleaned by revolving brushes, then carried by conveyor belt to a tray for grading (PN–1849). **Far right:** Stuart and Gould examine bulbs with a grading paddle (PN–1851).*

FROM THE COOL GROUND of Washington State to the flower markets of London and Western Europe is a common journey today for the bulbous iris.

The trip includes a brief stopover for cool storage and blooming in some of the 1,000 acres of greenhouses on the small, quaint Isle of Guernsey in the English Channel before the final leg of the journey to the Christmas flower markets. Since 1964, about 200 million iris bulbs have made this journey.

The year 1948 signaled the beginning of the cooperative forcing tests by ARS physiologist N. W. Stuart at Beltsville, Md., and plant pathologist C. J. Gould of the Washington Agricultural Experiment Station, Puyallup. At that time, the iris, a very popular cut flower, was generally available only in spring and summer. Forcing irises for the winter flower market was a gamble—stems produced no flowers or buds failed to develop. The need to overcome these difficulties provided the impetus for the studies.

The bulbous irises selected by Stuart and Gould were Wedgewood, Ideal and Blue Ribbon (Prof. Blaauw)—all popular in the cut-flower market and all some shade of blue. As the investigations progressed in pinning down the best temperature sequence and other environmental factors, a time-consuming process, iris forcing became a success in this country. The research led to further trials and success in Western Europe where similar problems existed. Today, Washington-grown bulbs have all but captured the early winter iris market of Western Europe.

The journey begins with the harvest of bulbs when they are mature, sometime in July in the Northwest.

Within 5 days of harvest, they are loaded into flats or trays and stacked in rooms where the temperature is held at 90° F. for 10 days—called heat curing. Curing matures the bulbs and helps prepare them for early flowering. Once the curing process is completed, the bulbs then start their journey by truck to the East Coast. Here, they are packed into the holds of ships below the water line where the temperature remains at about 65° F. throughout the ocean voyage.

Upon arrival at the greenhouses on the Isle of Guernsey, the bulbs are chilled at temperatures of 48° to 50° F.—Wedgewood and Ideal for 6 weeks and Blue Ribbon for 8 weeks. This cool-storage process prepares the bulbs for forcing. After cool storage, bulbs are sometimes held at 65° to 70° F. for 7 to 10 days before planting if the grower wishes to reduce the length of leaves and thus avoid a grassy appearance of the plant.

Bulb planting occurs on this Channel island about the first of November, and flowers are ready about 8 weeks later for the last leg of their journey to the English flower markets for the holidays. Here the journey ends to the delight of London housewives.

Since iris bulbs remain dormant at warm temperatures, they can be held at 80° F., then cool-stored and planted at desired intervals to provide flowers throughout the long winter months. ■

black gravel

a good mulch for tomatoes

BLACK GRAVEL MULCHES raised tomato yields up to 10 pounds per plant without irrigation in Great Plains tests.

ARS soil scientists M. L. Fairbourn and W. D. Kemper at Fort Collins, Colo., conducted the tests to determine the effects of black and white gravel mulches on tomato plants. Soil was left bare in control plots.

Some 6 weeks after planting, there was prominent contrasts in size, color, and succulence of plants on mulched plots as compared to those of control plots. Differences increased as the season progressed. Plants on the mulched plots were vigorous and spreading with medium green color and moderate succulence while those in the control plots were stunted, deep green, and woody.

Planting date was May 19, and ripe tomatoes were picked from August 5 until the first killing frost October 3. The black gravel-mulched plots yielded 10.27 tons per acre; the white-mulched plots, 8.80 tons per acre; and the bare soil, 2.86 tons per acre.

As the harvest proceeded, it became increasingly obvious that tomatoes grown on black gravel were more uniform, freer of end rot, and larger than those on white gravel or bare soil. These differences were probably due to higher soil temperature and reduced reflected light associated with black gravel.

But the increase in yield on the gravel-mulched plots was caused by the conservation of soil water. Much of the water was lost through evaporation from the bare soil of the control plots.

Tests made before planting showed that there was only 1 inch of water available in the top 4 feet of soil. The only water added to the plants, with the exception of 5.1 inches of rain during the growing season, was 1 quart of water to each plant when transplanted to the plots from the greenhouse. Frequent weeding kept weeds from competing with the tomato plants for soil water.

In preparing the gravel plots, gravel was spread over the ground to a depth of 1 to 1½ inches and sprayed with black or white paint. Fertilizer was applied by drilling it in the 4-inch strips left for crop rows. In this case, ammonium phosphate was used at a rate of 250 pounds per acre.

Fairbourn and Kemper, who had the cooperation of the Colorado Agricultural Experiment Station, say this research indicates that home gardens located on clay loam or silt loam soils in semiarid regions can produce good yields of tomatoes by using the dark gravel mulch. If dark gravel is unavailable, the darkest color of gravel common to the local area will do a good job of conserving soil water and improving yields. ■

Above: Agricultural engineer Jerry Bucheim with the U.S. Bureau of Reclamation calls on local farmer George Glarborg of Paul, Idaho, to pick up data needed for the computer (PN–1852). ***Right:*** *Jensen feeds information into the computer at the time-sharing terminal in Kimberly (PN–1853).*

when to irrigate? ASK THE COMPUTER

GOOD IRRIGATION MANAGEMENT is still more of an art than a science—but things are changing. Although technology has substantially increased the potential for better irrigation management during the past 15 years, timing schedules are about the same as they have always been. Scheduling by farmers is tuned more to the calendar or to convenience, to fixed rotation schedules, or even to "when a neighbor does" than to scientific priciples.

But results of ARS research using a computer program to predict the time and amount of the next irrigation indicate that such a program is both practical and a service that most farmers would welcome.

ARS agricultural engineer M. E. Jensen, Kimberly, Idaho, has developed a time-sharing computer program that estimates soil moisture depletion, the timing of the next irrigation, and the amount of water to be applied. His current study includes 24 farms, 43 fields, and 14 crops throughout southern Idaho. One irrigation district near Rupert, Idaho, is also testing this program on 86 fields under the guidance of the U.S. Bureau of Reclamation.

The program was written for the computer at the Salt River Project in Arizona, and C. E. Franzoy, senior engineer with the Salt River Water Users' Association, is testing the idea on 19 farms (2,162 acres), and 10 crops in the Salt River Valley. Within 3 years, many irrigation projects in the West and the Great Plains are expected to provide a scheduling service to their water users.

Time-shared computer facilities located at Los Angeles with a remote terminal at Kimberly perform the thousands of computations needed. An experienced technician is still an essential part of the program. He visits the farmer or irrigation manager and furnishes several charts and tables which serve as an introduction to an irrigator's handbook. The farmer supplies some of the essential information going into the computer.

After the computer is fed data concerning evapotranspiration, crop water use, dates and amounts of last irrigation or rainfall, the computer automatically furnishes the following information to the farmer: Crop and field identification, date of last irrigation, rainfall since last irrigation, estimated depletion of soil moisture, optimum depletion (varies with growth stage), estimated days before next irrigation, approximate amount of water to apply, and a general climatic forecast.

The cost of providing a management service such as this should be low when it serves fairly large acreages. Estimates are that costs will run about $1 per acre on the basis of a 600-acre average farm. Similar costs are possible for the smaller farmer if the level of service and frequency of visits can be reduced. The lowest-cost service might be one that comes from the Extension Service or similar groups that could publish or broadcast daily reports such as "if you haven't irrigated beets for 8 days, you should plan to irrigate within 3 days."

The studies continue in cooperation with the Idaho Agricultural Experiment Station, the U.S. Bureau of Reclamation and the U.S. Weather Bureau.■

still testing for a TGE VACCINE

A VACCINE to protect pigs from transmissible gastroenteritis, although seemingly workable, remains teasingly out of practical reach.

In the field, transmissable gastroenteritis (TGE) strikes unpredictably and kills off most pigs under 2 weeks old. Frequent, large doses of blood serum from the sow fed to pigs can furnish enough antibodies to temporarily protect them against TGE. But feeding serum is hardly practical. Fortunately, it is possible for serum antibodies to pass from the sow's blood into her milk, where nursing pigs can pick them up.

But how to stimulate antibody production in the sow? Farmers in the midst of a TGE outbreak with sows yet to farrow have tried to do the job by feeding the sows ground-up intestines from pigs that died from TGE. This practice is dangerous, of course, since it spreads TGE and every other infection contained in the intestines.

Over the years, several veterinary biologics manufacturers have explored making a killed virus TGE vaccine. Although in 1965 one such vaccine received a "special license" from ARS for conditional marketing, the license had to be rescinded 2 years later because in practice, protection was poor. An alternative would be so-called "modified live" virus vaccine made by growing several virus generations in an artificial medium.

Two manufacturers asked ARS to evaluate experimental vaccines of this type. ARS veterinarian T. W. Tamoglia, of the National Animal Disease Laboratory, Ames, Iowa, obtained a group of second-generation specific-pathogen-free sows and vaccinated them twice, once near the beginning of gestation and again near the end. He isolated one 2-day-old pig from each litter for 24 hours, fed it virulent TGE virus, and returned it to the litter. This corresponds to a natural infection in which one pig is exposed and then spreads the disease to its littermates.

Tests are aimed at determining if antibodies in vaccinated sows pass into the milk in consistently high-enough numbers to protect pigs. This pig from a test litter with an advanced stage of disease did not get enough antibodies (PN–1854).

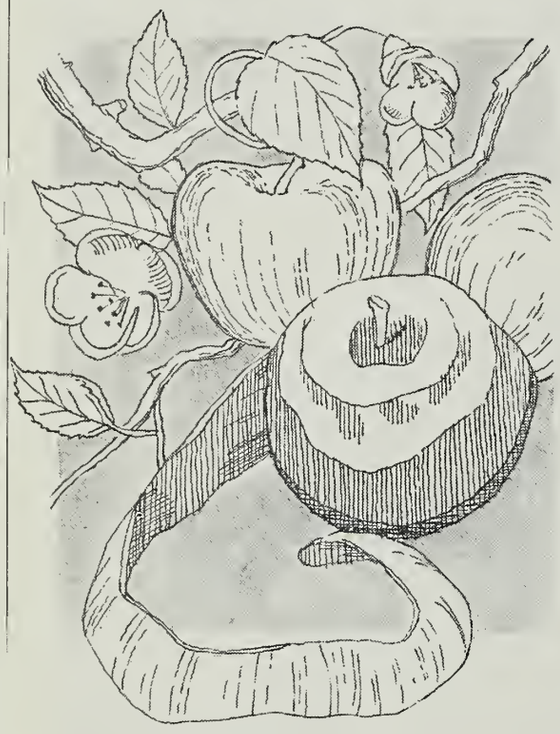
Other sows acting as controls were not vaccinated, but their litters were exposed to TGE in the same manner.

Pigs from vaccinated sows averaged 50 percent survival after TGE exposure, while pigs from unvaccinated sows averaged 40 percent survival. But Tamoglia's results show no direct correlation between success in stimulating blood serum antibodies in the sow and success in passing these in the milk, or success in protecting pigs exposed to TGE virus. At the extremes, one vaccinated sow on test had a high blood serum antibody titer (1:891) and a low milk antibody titer (1:27) and 60 percent of her pigs survived after challenge. But another sow had a low blood serum antibody titer (1:59), yet a high milk antibody titer (1:213) and 75 percent of her pigs survived.

Results were not definitive enough to warrant licensing a commercial product, Tamoglia says, but close enough to the mark to motivate industrial researchers to keep trying.

He expects to be able to evaluate future vaccines more quickly and accurately than past products, thanks to a sensitive challenge method just developed by ARS and several State agricultural experiment stations. In research now underway, a viral strain specially adapted to this challenge method looks very promising. ■

VAPORS THAT DE-WAX APPLES



LYE PEELING—the process of dipping raw fruits and vegetables into a hot lye bath to loosen the skin so it can be brushed or rubbed off—doesn't work with fruits such as apples which have waxy skins.

This waxy skin keeps in moisture and retains freshness but it also strongly resists lye penetration. And if too much heat and lye are needed to loosen the skin, the tissue immediately underneath softens and actually begins to cook. When the skin is removed, this tissue goes with it, resulting not only in loss of product, but in an effluent that will require treatment before it can be discharged into a stream. ARS chemists W. O. Harrington and C. H. Hills of the Eastern utilization laboratory in Philadelphia, Pa., found that exposing apples to the vapors from boiling alcohol for some seconds effectively removes the wax. Thus dewaxed, apples can be lye-peeled with 50 percent less heat.

But application of the combined dewaxing and lye-peeling of apples has been waiting on the development of automatic coring machinery. The labor-saving advantages of lye peeling are largely lost if apples are cored by hand or manually positioned for machine coring as they must be with existing equipment. A new fully automatic coring machine made in Italy has now come on the market, however, and if it proves adaptable to lye-peeled apples, it may completely automate the process.

Although originally developed for apples, dewaxing has had its first commercial application to tomatoes. Tomatoes bred for their adaptability to mechanieal harvesting are difficult to peel by eonventional lye processes without excessive loss of fruit. A commercial proeessor in California reports that by dewaxing first, he improves the quality and inereases the yield of his canned tomato pack.■

wheat bran breakdown

WHEAT BRAN has a well-deserved reputation for being rich in nutrients, but it does not often live up to its reputation for being *nutritious*.

Recent ARS findings reveal why an important part of the nutrients in bran are often not digested and indicate what can be done to increase digestibility. The studies were conducted by chemists R. M. Saunders, H. G. Walker, and G. O. Kohler at the Western utilization research laboratory, Albany, Calif.

Wheat bran got its reputation because of nutrients contained in tough-walled cells that are almost unknown among nonscientists. These are the aleurone cells. They are literally loaded with proteins, B-vitamins, minerals, and fats. Therefore, studies of nutrient availability, for practical purposes, boil down to studies of digestibility of aleurone cell contents.

The ARS study also included digestibility of the nutrients in wheat shorts, another milling byproduct, since aleurone cells are an important part of shorts.

Poultry nutritionists have shown that if bran is an important part of a ration, its nutritional value can be considerably increased by steam-pelleting. Findings by Saunders, Walker, and Kohler explain why: Physical force exerted during the steam-pelleting process ruptures the heavy aleurone cell walls and gives digestive enzymes acecss to the nutrients. If the heavy cell walls are not ruptured before the feed is eaten. many of them pass through the digestive system without being utilized by the body.

In the ARS tests, protein digestibility inereased proportionally to the number of aleurone cells ruptured before feeding. Adding grit to a bran ration also increased utilization of aleurone cell contents.

Now that they have determined the importance of breaking aleurone cell walls to inerease digestibility, the ARS scientists are further investigating processing methods to determine the best way to do it.

Their studies are branching out to include other cereals and cereal products and forages, as well.

In all probability, cell-wall rupture is of widespread importance because, as the scientists note, wheat bran is far from the only ingredient in food and feed that has tough cell walls.■

Check Dark Mink Too

Deaths of blue mink from Aleutian disease should alert ranchers to the possibility of this disease in their dark mink, even though the dark animals may appear healthy.

The Aleutian gene is responsible for the beautiful Sapphire, Aleutian and other highly desirable blue mutation mink. Unfortunately, these lighter colored blue mink are also very susceptible to Aleutian disease. ARS veterinarian J. R. Gorham at Pullman, Wash., says that even though dark mink rarely die of Aleutian disease, they may carry it and infect the blue mink.

Mink affected with Aleutian disease bleed at the mouth, become thin and may die within a month or less of kidney disease. Affected dark mink rarely die before pelting, and some live for years.

The best control for Aleutian disease is to remove at pelting time every mink that tests positive—dark and Aleutian types alike, then disinfect all equipment and restock with mink that test negative.

New Clematis Close to Ideal

A dream ornamental: Summer-long bloomer with a profusion of large, fragrant flowers; a dense and graceful plant that is easy to cultivate, hardy in winter, and able to withstand drought.

These laudatory adjectives only begin to describe a cultivar of *Clematis viticella* at the National Arboretum.

The new clematis (PN–1855).

ARS botanist T. R. Dudley observed this perennial climber in a private garden in New York State and recognized it as an unusual cultivar of *C. viticella* whose native home is in southern Europe and western Turkey.

Dudley brought cuttings of the plant with him to the Arboretum where he officially documented its botanical description and cultivar name, Betty Corning, and observed its merits and cultivation requirements.

The bell-shaped, violet-blue flowers bloom in Albany, N.Y., from June through September and in Washington, D.C., from May through October. It has admirably withstood temperatures as low as −20° F. It is a vigorous climber with rich, dark-green foliage in full sunlight and trains well on trellises, fences, and posts.

Although at present there are only 30 plants growing at the Arboretum, stock will be released to nurserymen sometime in late 1970 or in 1971.

Antibiotic Curbs Pecan Disease

Annual treatments of terramycin experimentally controlled crown gall disease in pecan trees.

Now a major concern of some commercial pecan growers and nurserymen, crown gall is a bacterial disease sometimes carried by nursery trees into new orchard plantings. Once the disease is present in an orchard, it spreads to healthy trees that become damaged by orchard cultivation or by propagating tools. Even when diseased trees are removed, the soil remains infected with the gall-producing bacteria.

In a 10-year research effort to find a control for the disease, ARS pathologist J. R. Cole worked with four different antibiotics. Only those trees treated with terramycin showed favorable results.

After gaining control of the disease on laboratory nursery trees, Cole extended his findings to mature trees in the field where the disease was confined mainly to the roots and bases of trees. A yearly treatment of a terramycin solution poured around the base of each tree controlled the disease.

The only side effect of the treatment observed by Cole was the premature shedding of nuts on several treated trees. Pecan nuts are especially sensitive when immature, and all nuts will occasionally shed on terramycin-treated trees.

Terramycin is not registered by the USDA for use on pecan trees.

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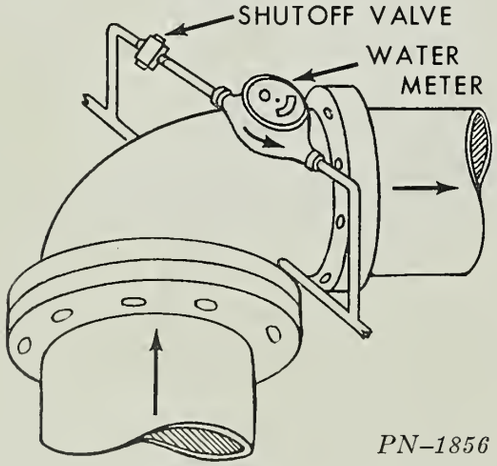
AGRISEARCH NOTES

Totalizing Meter

Household water meters could be a boon to people charged with metering irrigation water supplies.

The low-cost meters are well suited for use across differential-head devices like an elbow meter. Differential-head devices have differing pressures, such as in a 90-degree pipe elbow, for example. There, centrifugal force



PN–1856

causes water to exert greater pressure on the elbow's long outer curve than on its short inner curve. The difference in pressure can be used to measure the rate of flow through the meter at any given time but not, however, the total flow for an hour or a day.

But modifying the long-used elbow meter (AGR. RES., Sept. 1962, p. 11) with a water meter will provide a low-cost totalizing meter, says ARS hydraulic engineer J. A. Replogle.

The ability to measure total flow is frequently desired by irrigation water suppliers as a means of customer billing and by water users as a convenient method of learning how much water they have used, especially if the application rate is variable.

The elbow flow meter has openings on the outer and inner curves that are connected to the water meter by tubing. After the water meter is calibrated with a pressure gage, the same principle that made the elbow meter a rate meter works for the totalizing meter. The greater pressure on the outer curve of the elbow causes water to flow through the meter to the lower pressure on the inner curve, with the amount flowing through recorded on the dial of the meter. This reading is then related to the flow in the main line.

Replogle, who works at the U.S. Water Conservation Laboratory at Phoenix, Ariz., says the metering system is best suited to clean flows such as those normally pumped from wells.

Storing Strawberry Plants

The failure experienced by commercial nurserymen in storing unhardened, fall-dug strawberry plants may be related to improper storage temperature.

Ordinarily, strawberry plants left in the field, particularly if unmulched, are subject to winter injury or death from low temperatures and alternate freezing and thawing. With precise cold storage temperature controls, commercial growers may be able to avoid these problems while still maintaining strawberry plant quality.

ARS horticulturists J. T. Worthington and D. H. Scott conducted 5-year studies in Maryland on fall-digging and cold storage of commercial strawberry plants. After being dug, the plants were cleaned (runners, debris, dead leaves, and soil removed), and then bundled and packed in polyethylene bags which were closed during storage by simply overlapping the opening.

The results of the tests for three or four commercial varieties indicate that most fall-dug plants can be stored successfully for 5 months at precise temperatures from 30° to 32° F., depending upon the variety. Temperature variations of no more than 0.5° F. should be allowed. Removing all the leaves before storage seems to have no detrimental effects on the plants.

Worthington and Scott caution, however, that in locations other than Maryland, tests with a few fall-dug strawberry plants should precede any large-scale commercial trials.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

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